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THE GHOST CRABS *(OCYPODE)* OF DIRK HARTOG ISLAND

By B. M. ALLENDER.

INTRODUCTION

In September 1967, Wesley College conducted an expedition with 28 boys to Dirk Hartog Island. Of this number, a group of five students was involved in marine biology projects. One of these projects was a study of the behaviour and other seleeted characteristies of the ghost crabs of the island. The observation team comprised J. Gliddon, C. Hoskin, D. Masters, M. Saunders, G. Shaw, and the author.

PROCEDURE AND ECOLOGICAL OBSERVATIONS

Two localities were examined for crabs—three northern beaches around Cape Inscription, and the beach south of Sandy Point (Fig. 1). The northern beaches were small and shallow,

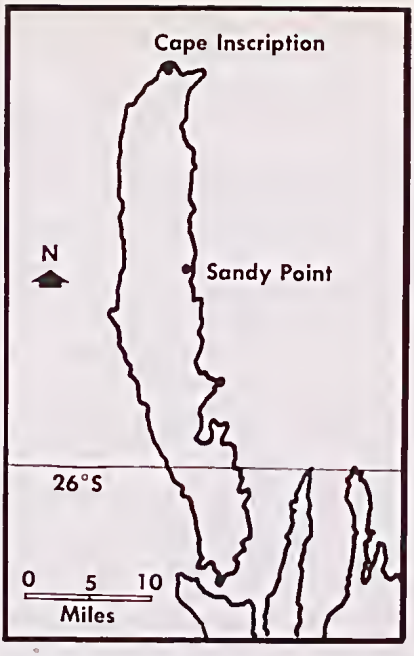

Fig. 1.—Dirk Hartog Island, Shark Bay, Western Australia.

and interspersed with rocky outcrops. At Sandy Point an extensive sandy beach lined a long bay to the south.

During daylight hours the crabs remain within their burrows which are dug at an acute angle into the beach. At night, however, they emerge and move down the strand for feeding. Thus for counting large numbers of crabs it was simplest at night using head torches. The team operated on September 6 and 7 between 2000 and 2100 hours at the northern beaches, and on September 8 for a similar time period at Sandy Point.

Apart from subjective records of crab behaviour and burrows, individual crabs were scored for the parameters of sex, whether right or left hand cheliped was larger, carapace width (measured in inches between the outer orbital corners), angle of burrow in relation to the sea, burrow depth and diameter when associated with crabs. The collated data were tested where appropriate using the Chi square test and t test within the 0.05 probability limit.

When disturbed on the surface all crabs initially ran away in typical sideways fashion. At close range they tended to curve around in their running and face the aggressor. More rarely crabs became defensive with a display of chelipeds and without attempting to move away. If not pursued, the crabs ran along the beach to just beyond the head torch beam. They only entered the sea or their burrows if these were very close (within a few feet). Many of the crabs observed were well down the strand on damp sand exposed by the receded tide or the wash of the waves. The concentration of crab activity towards the sea was also indicated by the crab tracks which fanned out from the burrow entrance only towards the sea.

IDENTIFICATION

Three crab species were observed during the survey. *Ocypode convexa* Quoy and Gaimard, *O. ceratophthalama* Palas, and *O. fabricii* Milne Edwards were identified using the key and descriptions of George and Knott (1965). These are the only three species recorded from this area by George and Knott, who described *O. convexa* with a Western Australian distribution as far north as Barrow Island, *O. ceratophthalama* with an Indo-Pacific distribution (including Dorre Island, 16 miles north of Dirk Hartog Island), and *O. fabricii* from northern and western Australian coasts as far south as Shark Bay. The type locality for *O. convexa* is Dirk Hartog Island.

RESULTS

1. Ocypode convexa

This species was recorded from both sampling localities. Mainly the crabs were scattered all along the beaches, with each individual apparently behaving independently of its neighbours. However at one area, a small sloping, limestone surface at Sandy Point, there was a very heavy density of crabs with only inches between individuals close to the waterline. Perhaps the organisms associated with the rock were more nutritionally desirable, or capable of supporting a heavy feeding load of crabs.

Considering each locality separately, there was a random distribution of sex, relative cheliped size, and sex with relative cheliped size (Table 1). There was no significant difference between carapace width data for sex, cheliped size, and chelipeds with sex (Table 3). Of the three crab species, *O. convexa* was the most common. Comparison of the carapace widths with those of George and Knott, indicates that there was only an adult catchable population on the island. Furthermore the clustered size distributions show a stabilised mature population in which most crabs have reached their maximum dimensions.

George and Knott suggest that for species at City Beach, Perth, the burrow entrances are always south of the bottoms of the burrow preventing sunlight penetrating the burrows. At Dirk Hartog Island the burrow angle was in relation to the sea—west sloping on the eastern beach (Sandy Point); and south sloping on the northern beaches. The deeper burrows always curved away from their entrances so that the burrow bottom was usually not visible from the surface. The curvature of the burrow would prevent full sunlight penetration. The burrow depth obviously varied with how long the crab had been digging, but generally the burrows were deeper in the sands of Sandy Point than in the shallower sands covering rocks of the northern beaches. All burrows were above high water mark, and no burrows reached the water table.

At Sandy Point only two burrows with crabs were located. However as the burrows were deep they were not excavated unless a crab could be seen within them, thus the number of occupied burrows was probably badly underscored. A more adequate sample was obtained from the shallower burrows of the northern beaches. During the excavation of a burrow the crab's behaviour was to dig into the base of the burrow and lie passively. Occasionally excavation would evoke an escape or aggressive mechanism and the crab emerged from the burrow very agitated.

The carapace widths of *O. convexa* were less than their respective burrow diameters (Table 2). Although the crabs entered and left their burrows sideways, they were dug with the crab's pos-

TABLE 1.—Numbers of crabs scored at the two sample localities for two species, in terms of whether L.H. or R.H. cheliped is larger, sex distribution, and cheliped size within the sexes.

	Total crab No.	Chelipeds		Males	Females	Males		Females	
		L.H. lgr.	R.H. lgr.			L.H. lgr.	R.H. lgr.	L.H. lgr.	R.H. lgr.
O. convexa									
northern beaches	35	17	18	20	15	9	11	8	7
Sandy Point beach	72	35	37	33	39	17	16	18	21
O. ceratophthalama									
northern beaches	31	15	16	16	15	8	8	7	8

TABLE 2.—Sex distribution of occupants, mean burrow diameters, and the mean carapace width of crabs associated with their burrows. From the northern beaches populations.

	O. convexa	*O. ceratophthalama*
Males associated with burrows	16	5
Males running on beach	4	11
Females associated with burrows	2	4
Females running on beach	13	11
Mean burrow diameter	1.8 ins.	1.5 ins.
Mean carapace width of occupant	1.5 ins.	1.1 ins.

terior pereipods and thus dug to the crab's width dimensions. Since crabs foraging on the beach were easier to collect than those in burrows, only burrows known to contain crabs (at bottom, at entrance, entering or leaving) were excavated. This introduced a sampling bias towards those foraging compared to the numbers within burrows. The high percentage of male burrow occupants compared to the total number of burrow occupants (and to the total number of males) (Table 2), suggests that most males forage at a different time of the night to females, or at least forage closer to their burrows and dart into them when disturbed.

2. *Ocypode ceratophthalama*

This species was only observed at the northern beaches. Individual crabs were scattered along the beaches, usually closer to the water line than individuals of *O. convexa*. There was also a smaller population sample caught (Table 1).

Table 1 shows there was random distribution of sexes and cheliped sizes. Also there was no relation between cheliped size and sex. For the carapace width data, there was no significant difference within the character groupings of cheliped size, and cheliped size with sex (Table 3). However there was a significant deviation in the size of the sexes, with the male having shorter carapace width (Table 3). Overall for *O. ceratophthalama* there was a greater range of carapace widths recorded. From the carapace widths given by George and Knott (1965) this represents a catchable population of mainly adults with only a few juveniles. All crabs within the juvenile dimensions were males. George and Knott indicate that adult crabs of both sexes have approximately the same carapace widths, therefore the sample population comprises a younger male population and an older, larger female component. According to George and Knott, the maximum size of this species is smaller than the maximum of *O. convexa*. These data show the same general feature (Table 3).

The burrow details and associated crab behaviour parallels that already described for *O. convexa*. Invariably the crabs of this species remained passively in their burrows during the excavation. Burrow occupancy numbers suffer from the same sampling limitations as for *O. convexa*. However Table 2 indicates that most individuals of both sexes forage at the same time, with about the same number of males as females remaining in their burrows.

3. *Ocypode fabricii*

Two specimens, a male and a female, were excavated from their deep burrows, above high water mark, at Sandy Point during daylight. None of this species were seen on any of the night time observations.

CONCLUSIONS

Ocypode ceratophthalama appears to prefer the shallower northern beaches, with an equal catchable population of *O. convexa* in this area (Table 1). Also *O. convexa* is the major occupant of Sandy Point beach. The scarcity of *O. fabricii* records may be because crabs are rare, or perhaps they forage at a different time of night. By a similar argument the populations caught of the other two secies could vary during the night. Generally *O. convexa* appears less selective for environment than the other two species. It also is the more successful species in terms of a mature, adult population compared to *O. ceratophthalama*, which has a younger population component, still reaching maturity.

Of the other crab characters examined, there is no selective advantage for sex or cheliped size, and the characters segregate

TABLE 3.—Carapace widths (inches) of crabs from the three sample populations. The populations are designated in terms of sex, and whether the L.H. or R.H. cheliped is the larger.

	Carapace Width (inches)													
	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
O. convexa														
northern beaches:														
Males L.H.							1			1	4	2	1	
Males R.H.								1		2	3	2	2	1
Females L.H.											1	4	2	1
Females R.H.										1		4	2	
Sandy Point beach:														
Males L.H.							1			1	3	6	5	1
Males R.H.										1	3	4	6	2
Females L.H.											2	9	6	
Females R.H.											4	12	5	
O. ceratophthalama														
northern beaches:														
Males L.H.	2	2		1		2	1							
Males R.H.				2					2		2			
Females L.H.					1				3	2	1			
Females R.H.							1		1		5			1

independently of each other. The general behaviour characteristics of species of ghost crabs as recorded by George and Knott are similar to those observed at Dirk Hartog Island.

ACKNOWLEDGEMENTS

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BIRDS AND KANGAROO PAWS

By ERIC H. SEDGWICK, Harvey

G. F. Mees, in his "A Note on the Pollination of the Kangaroo Paw, *Anigozanthos manglesii*." *(W. Aust. Nat.*, 10: 149) remarks upon the paucity of actual published records of birds visiting Kangaroo Paws.

In this connection the following abstract of my notes may be of interest, though only one refers to visits to the species *A. manglesii*.

Western Spinebill, *Acanthorhynchus superciliosus*

December 26, 1952, Nornalup. Hen observed probing Green Kangaroo Paw, *A. viridis*.

January 22, 1956, Augusta. Male probing Green Kangaroo Paw but, apparently disturbed by New Holland Honeyeaters, it retired to the tree-tops.

January 26, 1956, Augusta. Two birds at Green Kangaroo Paws. Many flowers are now dry, but a few bear pollen and the tubes contain nectar—in one, half way down; in a second, near the base.

February 3, 1959, Pemberton. A single bird was noted probing Green Kangaroo Paws by the Warren River.

January 4, 1961, Nornalup. Observed near bridge over river. One bird was visiting Green Kangaroo Paws. Six plants were visited before the bird flew to another species of plant—a tea-tree with a small flower—but was not observed to probe. The bird was then lost to view. Only "good"—not half dead—flowers were visited. Probing appeared to be without damage to the flower. Close examination showed that some of the old flowers were split, but not the fresh ones.

January 5, 1961, Quinninup. Three birds, visiting Green Kangaroo Paws.

Red Wattle-bird, *Anthochaera carunculata*

September 27, 1942, Perth, Kings Park. A Red Wattle-bird was observed visiting Kangaroo Paws, *A. manglesii*, and apparently taking nectar. This behaviour was continued for some time, many flowers being visited.*

* C. F. H. Jenkins (W. Aust. Nat., 11 1968: 19) has also discussed the role of the Red Wattle-bird as a pollinator of this Kangaroo Paw.—Ed.